THERMAL AND MECHANICAL PROPERTIES OF W/Cu COMPOSITE MATERIALS FOR ITER HEAT SINK APPLICATIONS

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One of the main challenges in the development of a fusion power plant is the adequate selection of the materials that will withstand the extreme conditions of temperature, load and radiation. Among those issues, the control of the heat removal by the divertor is critical, hence the highest heat load inside the reactor will be found in it. For this purpose, one solution proposed is a novel optimized water- cooled monoblock divertor consisting of W as plasma facing material and W/Cu composites as the baseline heat sink material. The attraction of these metal matrix composites in fusion applications is twofold: the W matrix provides the necessary strength of the composite at high temperatures, while Cu provides the required high thermal conductivity for efficient heat removal in the cooling system. In this context, the goal of this study is the characterization of W- Cu composite materials produced by means of liquid Cu infiltration of open porous W preforms. In order to achieve it, a new experimental device was set up to test the composites under high vacuum atmosphere while in the temperature range between 273 K and 1073 K. Tensile and fracture tests in three point bending configuration have been conducted in this temperature range and atmosphere. Additionally, micromechanical and physical characterization was also performed by means of micro and nanoindentation and High Temperature X- Ray Diffraction respectively.

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